US007083845B2

(12) **United States Patent**
Graff

(10) **Patent No.: US 7,083,845 B2**
(45) **Date of Patent: Aug. 1, 2006**

(54) **SHEET OF ABSORBENT CREPED PAPER, CYLINDER FOR EMBOSSING SUCH A SHEET AND AN EMBOSSING PROCESS**

(75) Inventor: **Pierre Graff**, Wolfgantzen (FR)

(73) Assignee: **Georgia-Pacific France**, Kunheim (FR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/258,232**

(22) PCT Filed: **Feb. 22, 2002**

(86) PCT No.: **PCT/FR02/00673**

§ 371 (c)(1),
(2), (4) Date: **Nov. 12, 2002**

(87) PCT Pub. No.: **WO02/068758**

PCT Pub. Date: **Sep. 6, 2002**

(65) **Prior Publication Data**

US 2003/0118782 A1 Jun. 26, 2003

(30) **Foreign Application Priority Data**

Feb. 23, 2001 (EP) 01400477

(51) **Int. Cl.**
D21H 27/40 (2006.01)
B31F 1/07 (2006.01)

(52) **U.S. Cl.** **428/166**; 428/156; 428/167; 428/172; 162/109

(58) **Field of Classification Search** 428/156, 428/166, 167, 172; D5/53; 162/109, 111, 162/113, 116, 117
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,414,459	A	12/1968	Wells	161/131
3,738,905	A *	6/1973	Thomas	428/154
3,867,225	A	2/1975	Nystrand	156/209
4,320,162	A	3/1982	Schulz	428/154
5,173,351	A	12/1992	Ruppel et al.	428/1.74
5,382,464	A	1/1995	Ruppel et al.	428/172
5,736,223	A	4/1998	Laurent	428/154
5,830,558	A	11/1998	Barnholtz	428/171
6,032,712	A	3/2000	Biagiotti	156/358
6,109,326	A	8/2000	Leakey et al.	156/553
6,277,466	B1 *	8/2001	McNeil et al.	428/154
6,287,676	B1 *	9/2001	Ruppel et al.	428/219
6,524,683	B1 *	2/2003	Roussel et al.	428/172

FOREIGN PATENT DOCUMENTS

EP	1 081 284 A1		3/2001
WO	WO 93/12293	*	6/1993
WO	WO 99/36253	*	7/1999

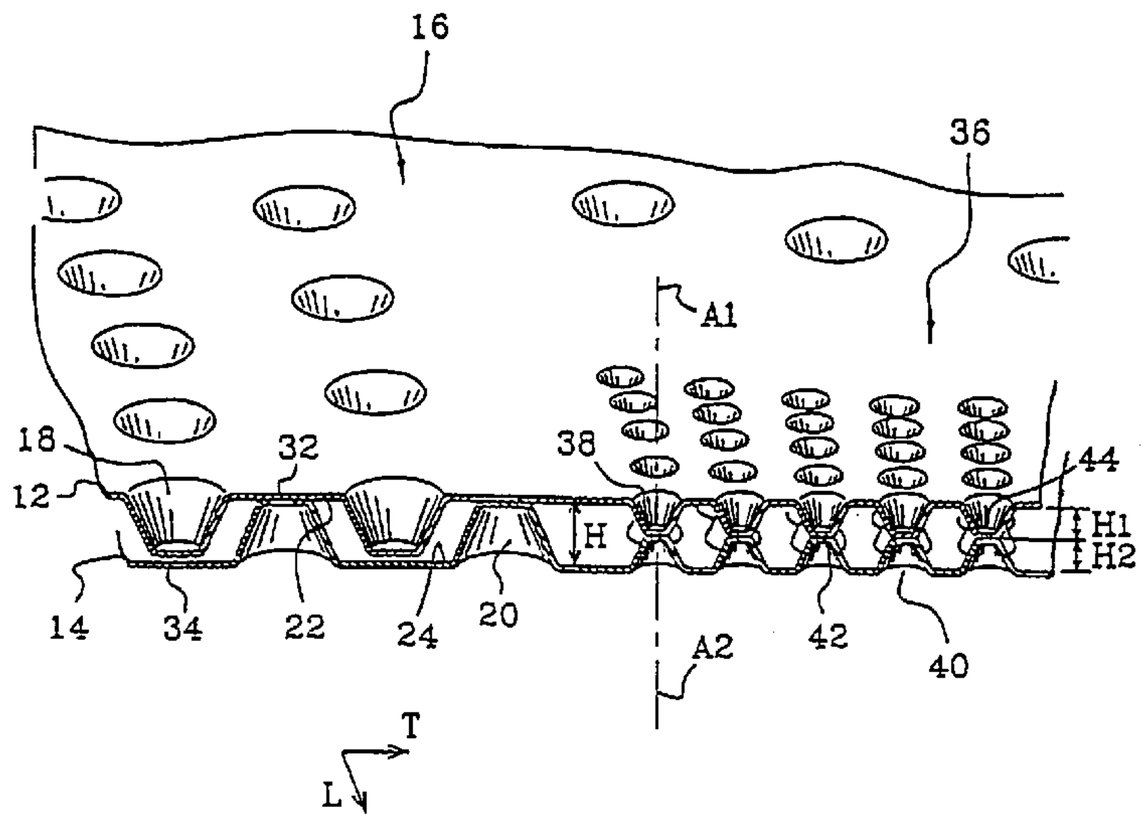
* cited by examiner

Primary Examiner—Alicia Chevalier
(74) *Attorney, Agent, or Firm*—Breiner & Breiner, L.L.C.

(57) **ABSTRACT**

The invention relates to an embossed sheet **10** made up of at least a first and a second ply **12**, **14** of creped cellulose cotton of the type in which the first ply **12** has an embossed design **16** involving a first series of first projections **18** that form in particular first alignments and in which the apexes **32** are connected to the internal face **24** of the facing second ply **14** characterized in that these two plies **12**, **14** each have a second embossed design **36** involving a second series of second projections **38**, **40**, and by the fact that the apexes **42**, **44** of the second projections **38**, **40** of a ply **12**, **14** extended outward and are facing and near apexes **44**, **42** of the second projections **40**, **38** of the other ply **14**, **12**.

7 Claims, 4 Drawing Sheets



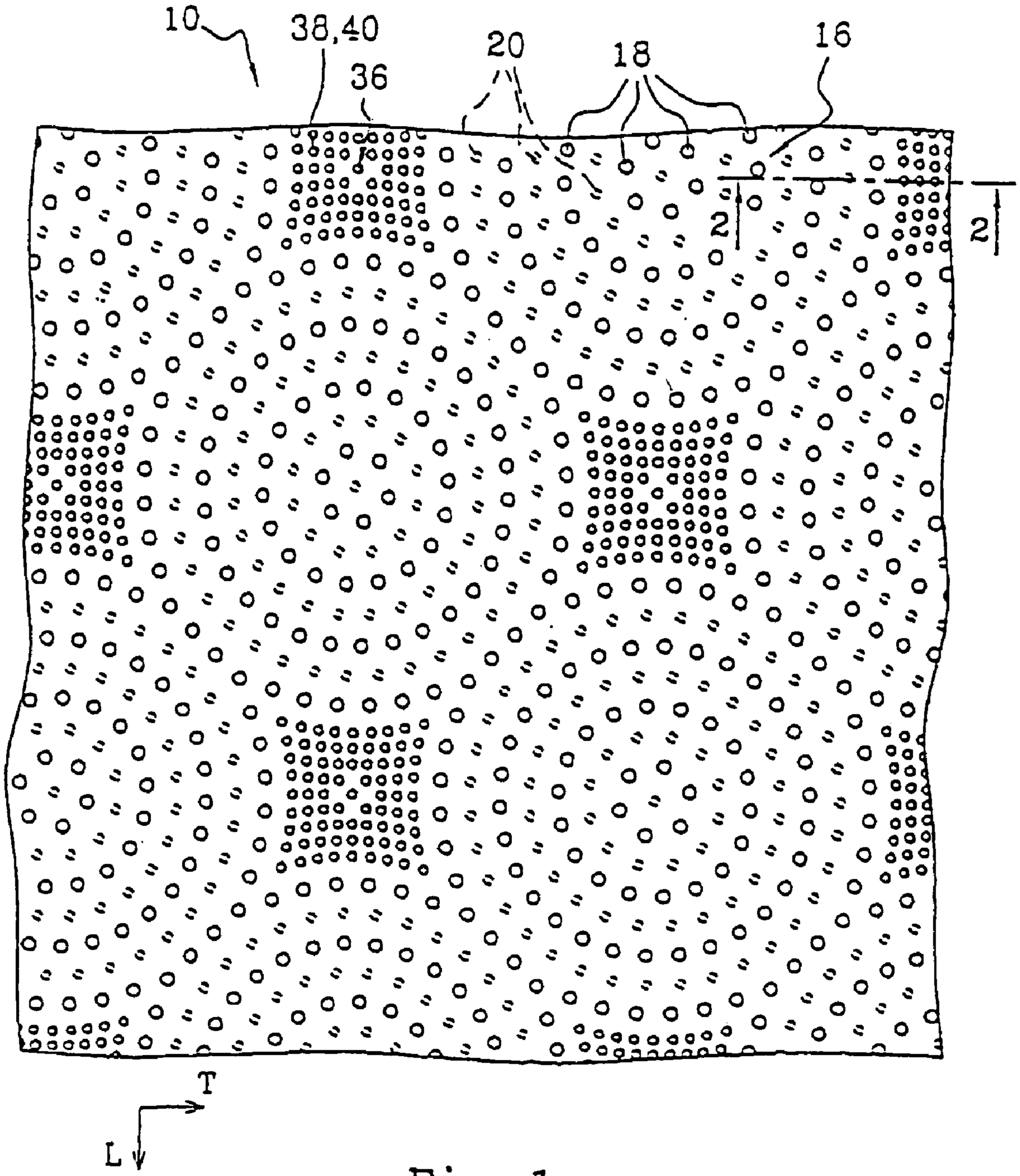


Fig. 1

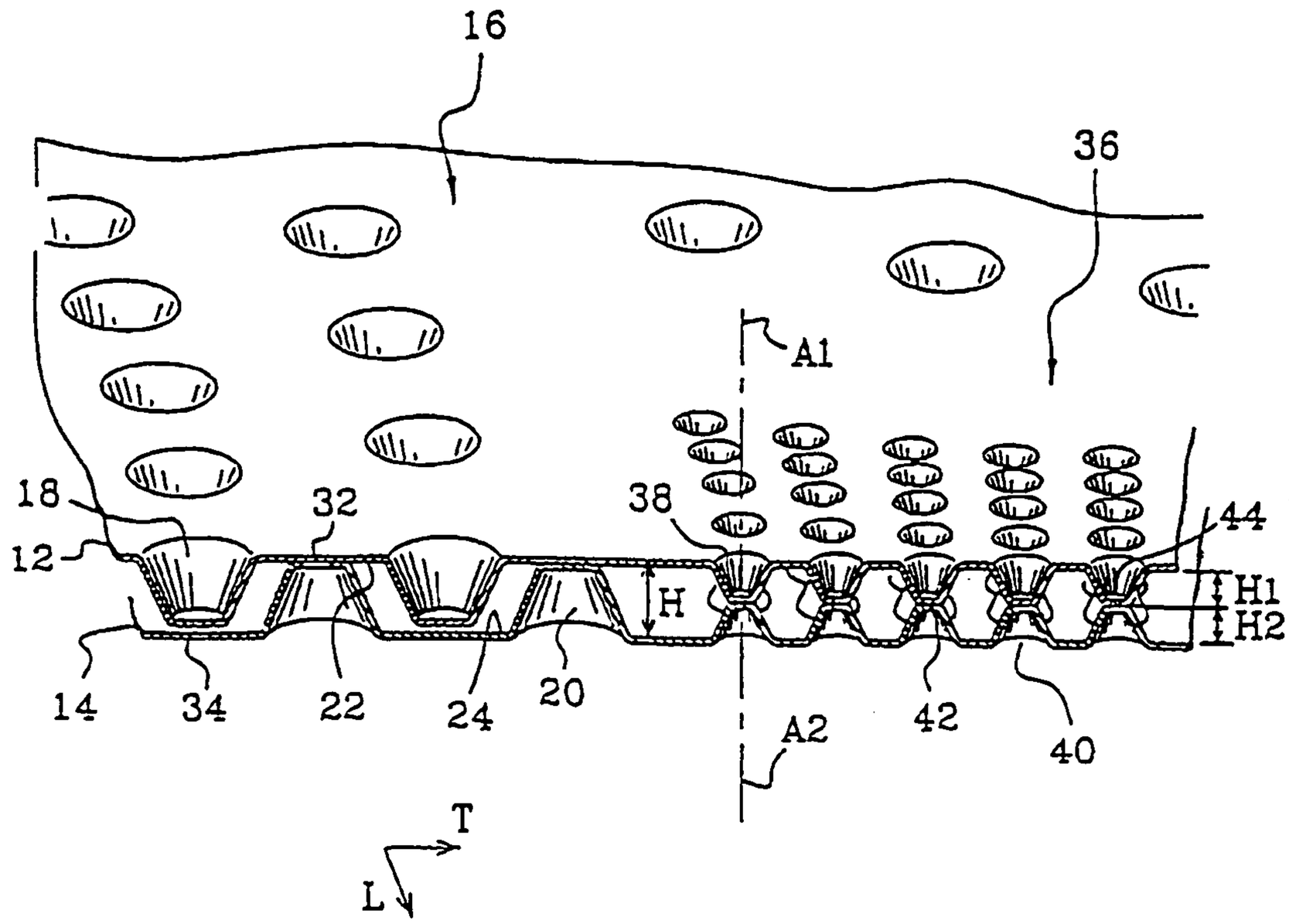


Fig. 2

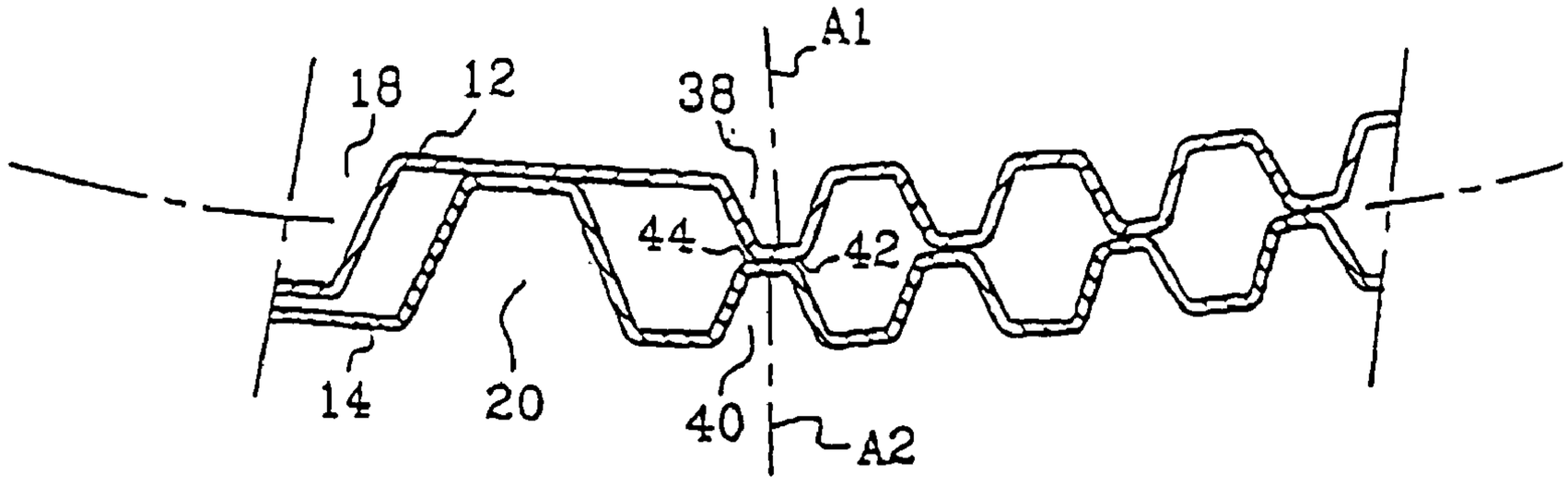


Fig. 3

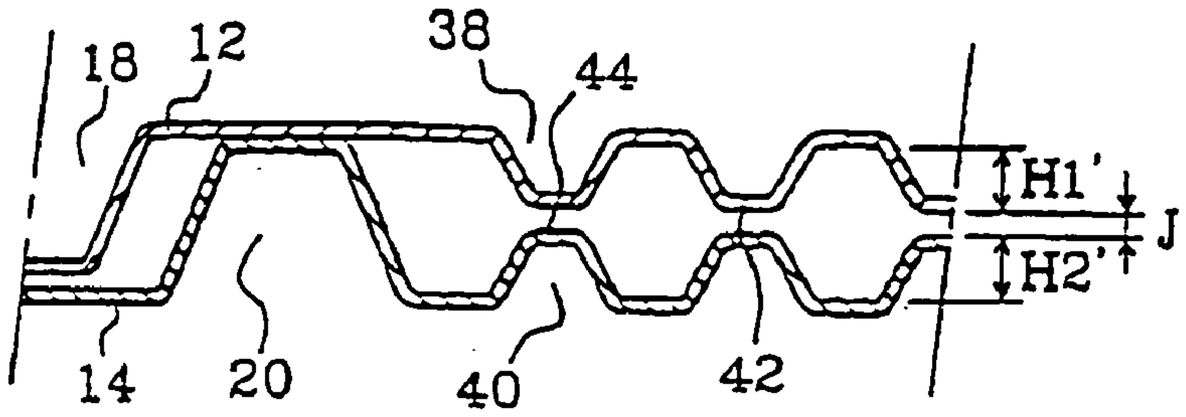


Fig. 4

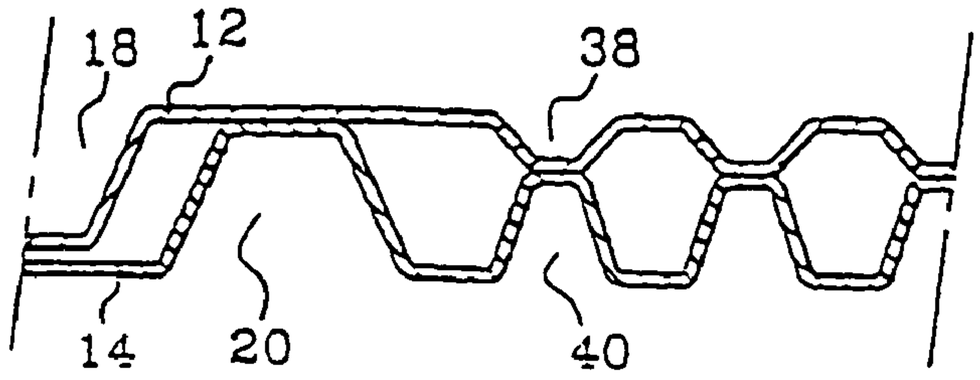


Fig. 5

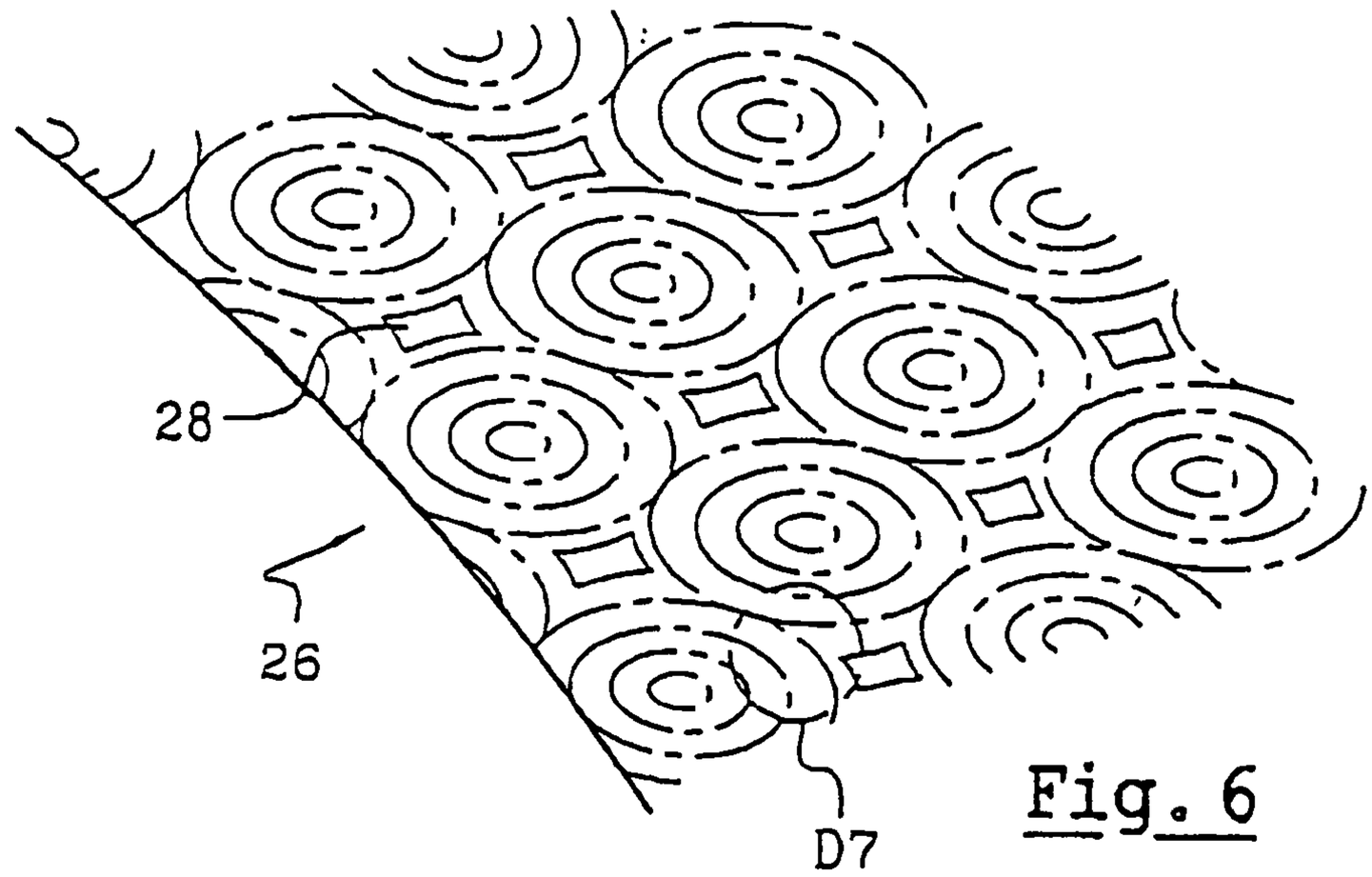


Fig. 6

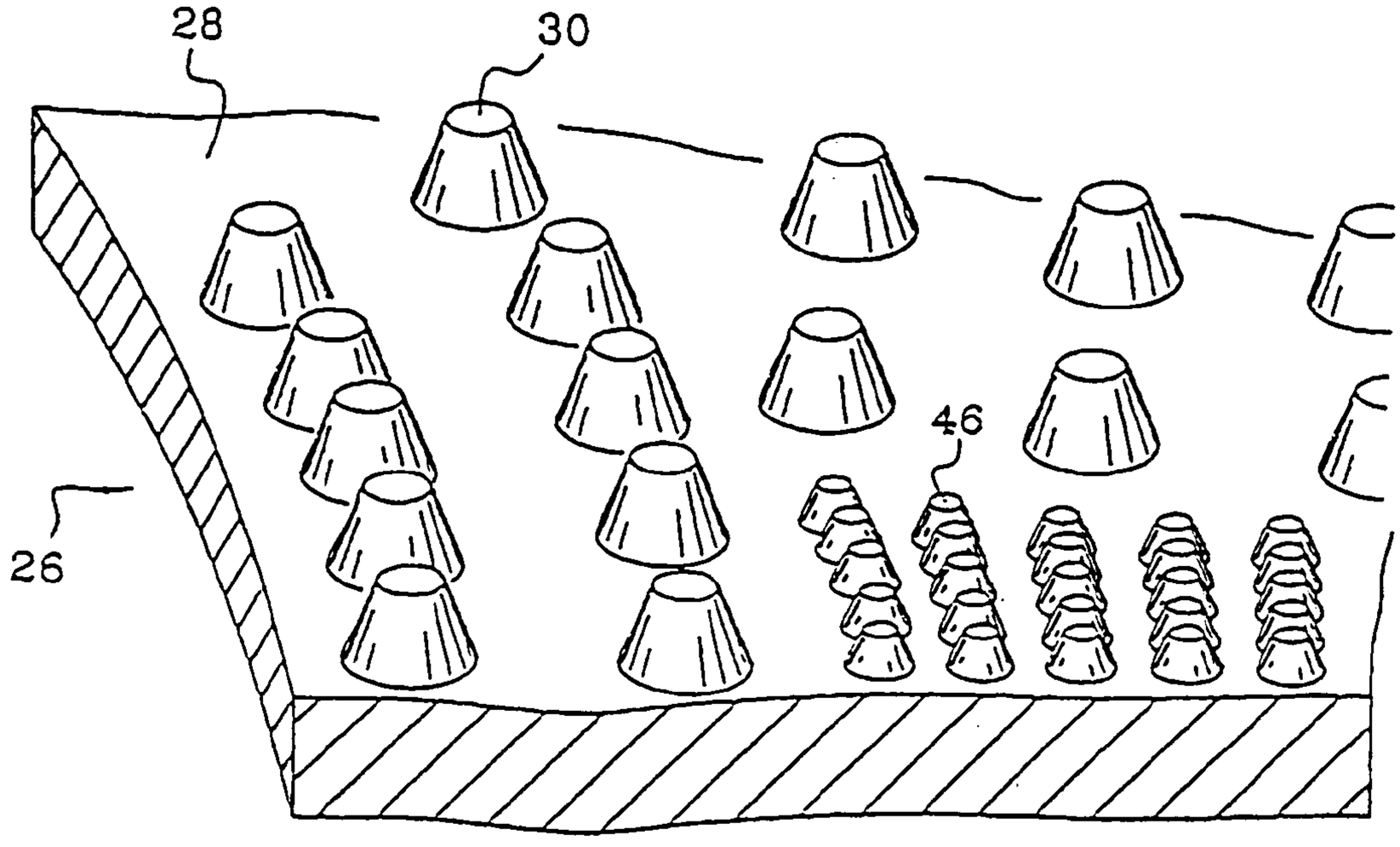


Fig. 7

SHEET OF ABSORBENT CREPED PAPER, CYLINDER FOR EMBOSSING SUCH A SHEET AND AN EMBOSSING PROCESS

FIELD OF THE INVENTION

The invention relates to a sheet of paper, in particular a sheet of absorbent paper of creped tissue having an embossed design pattern.

The invention relates particularly to a sheet of paper made up in particular of at least a first ply and a second ply of creped absorbent tissue paper intended for the area of application of wiping in household, domestic, and industrial use, that is, can be utilized as an all-purpose wipe, rag, etc.

BACKGROUND OF THE INVENTION

In the area of application of paper for sanitary or domestic use, such as toilet paper or all-purpose wipes, the production of sheets of paper made up of several plies of absorbent paper, such as of tissue paper, with a square meter surface measure weight ranging from 12 to 30 g/m^2 provided with projections which are obtained by embossing, is a known technique.

Embossing in fact imparts bulk to the sheet and leads to improvement in absorption of liquids, feel, and softness. An attempt has been made to increase the absorptivity further by creating multilayer sheets obtained by combining two layers, also called plies, each made up of at least one of such embossed sheets.

Thus, a multilayer sheet is obtained that has mechanical characteristics such as specific resistance to traction as well as a specific absorptivity.

Two methods of embossing and assembly of such plies are currently applied, depending on the characteristics desired for the final product.

The first is known in this particular field under the designation of the "nested" design method. It consists first of embossing each of the plies separately so as to form on the surface projections which are generally substantially tapered in shape or are shaped as truncated pyramids. Adhesive is then applied to the top or apex of the projections of one of the plies, and the plies are arranged so that the surfaces present facing the projections, with the projections of one surface being opposite the projections of the other surface. Lastly, the plies are assembled so that the projections which have been glued nest within the projections of the other ply. Thus the two plies are connected by adhesive points between the tops of the projections of one ply and the non-embossed zones between the projections of the other ply. A structure is thus created, the voids of which made in this manner are suitable to ensure improved absorption for the sheet. In addition, the outer surfaces have a smooth and soft feel due to the hollow areas formed by the back of the projections. This technique is shown in U.S. Pat. No. 3,867,225.

The second assembly method is known in this field as "tip-to-tip" assembly. It differs from the preceding method in the relative arrangement of the two plies. After the latter have been separately embossed, they are placed one on top of the other so that the apexes of the projections coincide or so that at least a portion of the apexes coincide. The plies are connected to each other by the tops of the projections, tip to tip. This technique is shown in U.S. Pat. No. 3,414,459.

When the practical embodiments of these structures, whether of the nested or tip-to-tip type, are examined, it is found that the projections obtained during embossing are most often produced in such a way as to be distributed according to a pattern in which the projections are generally aligned uniformly according to one or several directions. One such design permits a homogenous sheet relative to its mechanical characteristics to be obtained.

However, in order to improve user satisfaction, it is important to increase the suppleness of the sheet.

The suppleness of the sheet can be defined as being its capacity to be deformed regularly when it is placed in the hand of a user, his fingers being stretched out in an extension of his palm and when the user then pulls back his fingers.

A sheet of paper which presents a high degree of suppleness is then going to be deformed and be curved or cambered in such a way as to remain more or less parallel to the form determined by the interior of the palm of the hand of the user.

A sheet of paper which presents a low degree of suppleness will be folded along one or several lines, each part of the sheet that extends itself between two folding lines remaining more or less flat.

A sheet of paper which has a high degree of suppleness is more convenient to use.

Generally speaking, an increase in suppleness of the sheet causes in particular a decrease in its mechanical characteristics.

BRIEF SUMMARY OF THE INVENTION

An object of the invention is to propose a new design of an embossed sheet that will allow the suppleness of the sheet to be increased without diminishing its mechanical characteristics.

To accomplish this object, the invention provides an embossed sheet composed of at least one first and one second ply of creped tissue with a square meter surface measure weight ranging from 12 to 30 g/m^2 of the type in which at least a first ply has a first embossed design pattern comprised of a first series of first projections, generally tapered in shape and extending above the internal face of the first ply, which form in particular first alignments and in which the apexes are connected to the internal face of the second ply, characterized by the fact that these two plies each have a second design pattern comprising a second series of second projections extending above the internal face of a corresponding ply and by the fact that the apexes of the second projections of the ply extend outward and are facing and near the apexes of the second projections of the other ply.

Other features of the invention are that:

the apexes of the second projections of a ply are in contact with the apexes of the second projections facing the other ply;

the apexes in contact with the second projections are not connected;

the heights of the second projections of the two plies are substantially-equal;

each of the second plies has a first series of the first projections, generally tapered in shape and extending over the internal face of the ply, which form the first alignments;

the aligned projections of the first series form figures of a shape of a closed loop;

each of the two plies have a first series of first projections and an associated series of first projections, and the associated series of the first projections of the one and of the other ply are nested between the associated series of projections of the other of the two plies;

the second projections have dotted apexes;

the second projections have linear apexes.

The invention also provides a pair of engraved cylinders for embossing an embossed sheet as specified in any one of the succeeding claims in which at least one of the cylinders comprises a first series of first picots generally tapered in shape and forming the first alignments characterized by the fact that the two engraved cylinders each have a second series of second picots in relief, dotted, and/or linear in which each second picot of a cylinder corresponds substantially with a second picot of the other cylinder and in which the sum of the heights of the corresponding second picots is substantially equal to the height of the first picots.

Lastly, the invention provides a process for manufacturing an embossed sheet by means of a pair of cylinders according to succeeding claims, characterized by the fact that it involves embossing the two plies in such a way as to form the first and the second embossed design pattern, then assembling the two plies so that the apexes of the first projections are linked to the internal face of the facing ply and so that the apexes of the second projections of a ply extend outward and are facing and near the apexes of the second projections of the other ply.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features and advantages of the invention will become apparent in reading the following detailed description, the understanding of which will be facilitated by the attached drawings, wherein

FIG. **1** illustrates as viewed from above an embodiment example of a sheet of paper embossed in accordance with the teaching of the invention and more particularly a kitchen towel sheet;

FIG. **2** is a diagrammatic cross-section and perspective view of a sheet of embossed paper made in accordance with the teaching of the invention;

FIG. **3** is a diagrammatic sectional view of a sheet of embossed paper which is made in accordance with the teaching of the invention and which is slightly cambered;

FIGS. **4** and **5** are diagrammatic sectional views of a sheet of embossed paper made in accordance with variants of the embodiment of the invention;

FIG. **6** is a perspective diagrammatic view illustrating the convex cylindrical surface of an embossing cylinder of a ply of a sheet according to FIG. **1**;

FIG. **7** is a enlarged view of detail D**7** of FIG. **6**.

DETAILED DESCRIPTION OF THE INVENTION

An example of the embodiment of a sheet **10** of embossed paper is shown in FIGS. **1** and **2**, particularly a sheet comprised of a first upper ply **12** and of a second lower ply **14** of absorbent paper, of creped tissue, intended for all types of hygienic or household products.

The tissue paper, with a surface measure ranging from 12 to 30 g/m^2, is of the type obtained by Conventional Wet Pressing (CWP) or of the type obtained by Transverse Air Drying (TAD).

More particularly, the sheet of paper **10** shown in FIGS. **1** and **2** is, for example, intended for incorporation into a roll of a kitchen towel paper.

The sheet **10** is oriented along two longitudinal and transverse directions, shown in FIG. **2** by arrows L and T, which correspond to the direction of progression of the sheet **10** during its manufacture, also called the direction of "advance" and in the perpendicular direction respectively, also called the "transverse" direction.

After embossing, a first design pattern **16** is apparent and is visually detached from the first ply **12** and from the second ply **14** of the sheet **10**.

The first embossed design pattern **16** of each ply **12** and **14**, of generally known design, is comprised of a first series of first projections **18** and **20**, generally tapered in shape and extending above the internal face **22**, **24** of the corresponding ply **12**, **14** while also extending over the interior of the sheet **10**.

The first projections **18** and **20** form in particular the first alignments according to the drawings, in particular as closed loops which are seen here as circles.

Here, in accordance with FIG. **1**, the associated series of the first projections **18**, **20**, of the one and of the other ply **12**, **14** are nested, concentrically, between the associated series of the projections **20**, **18** of the other **14**, **12** of the two plies.

The first series of first projections **18** and **20** are aligned according to two principal directions in such a way as to define a ruled square quad. The two principal directions here are perpendicular between them and are inclined at 45 degrees relative to the longitudinal L and transverse T directions of the sheet **10**.

The apexes **32**, **34** of the first projections **18**, **20** are connected to the internal face **24**, **22** of the facing ply **14**, **12** (see FIG. **2**).

According to a known technique, the first projections. **18**, **20** comprising the elements of the first design pattern **16** are obtained by embossing the first ply **12** and the second ply **14** of the sheet **10** by means of a pair of cylinders, one of which is shown in FIGS. **6** and **7** as cylinder **26**.

The homologous "projections" of those sought to be obtained on the first ply **12** and the second ply **14** of the sheet **10** are formed in relief on the convex cylindrical external face **28** of the associated cylinder **26**.

For making the series of first projections **18** on the first ply **12** of the sheet **10**, the embossing cylinder **26** has on its convex cylindrical face **28** a first homologous series of picots in relief **30** generally tapered in relief, which are arranged in concentric circles along the first alignments of the first projections **18**, in such a way as to make the corresponding part of the first design pattern **16** of the first ply **12**.

Similarly, the series of first projections **20** on the second ply **14** of the sheet **10** is made by another analogous embossing cylinder in which the picots in relief are arranged as concentric circles along the first alignments of first projections **20**, in such a way as to make the corresponding part of the first design pattern **16** of the second ply **14**.

When the first ply **12** and the second ply **14** are embossed, they are assembled among themselves by gluing the apexes **32** or **34** of the first projections **18** or **20** on the internal face **24** or **22** of the second ply **14** or the facing first ply **12**.

In accordance with the teaching of the invention, and in order to improve the suppleness of the sheet **10** without diminishing its mechanical characteristics and its absorption capacity, the two plies **12**, **14** have a second embossed design pattern **36** involving a second series of second projections **38**, **40** which are, for example, generally tapered, i.e., with dotted apexes, extending out above the corresponding internal face **22**, **24** of ply **12**, **14**, while thus extending over the interior of the sheet **10**.

The axes A**1** and A**2** of the second projections **38** and **40** of the first ply **12** and of the second ply **14** are more or less aligned.

The second projections **38** and **40** are made similar to the first projections **18** and **20**, in particular by a second series of second picots **46** tapered in shape which extend to the convex surface **28** of the embossing cylinder **26**.

Each second picot of a cylinder corresponds preferably with a corresponding second picot of the other cylinder, and the sum of the heights of the corresponding second picots is substantially equal to the height of the first picots.

The second projections **38**, **40** form in particular the second alignments according to the figures, in particularly as closed loops, which are arranged between the first series of first projections **18** and **20**.

Here the closed loops have the general form of a square whose sides are curved inward and concave in a manner substantially parallel to the circles defined by the first projections **18** and **20**.

However, the second alignments may be of other forms, geometric or not, such as those of diamonds or flowers.

It is also possible that the second alignments of the second projections **38** and **40** have circles that are concentrically arranged in the circles of the first series of the first projections **18** and **20**.

As a variant not shown in the drawings !the second projections are not necessarily tapered projections with dotted apexes, but they can also be of a linear apex type defining more or less intricate linear design patterns.

The second projections can also be combinations of dotted apexes and linear apexes on the same ply, on the two plies or respectively on the one and on the other of the two plies.

When the second projections are tapered, they are preferably micro-projections in comparison with the first tapered projections with a density of micro-projections of between 30 and 80 projections per cm^2.

The diameter of the apexes of the picots in order to engrave the micro-projections is, for example, on the order of 0.4 mm while the former of the first (macro) projections is on the order of 1.0 mm.

By way of example, if the corresponding heights of the first picots **30** and of the second picots **46** formed by a relief on the cylinder **26**, intended for the embossing of a first ply **12** of a sheet of paper are considered for use as a kitchen towel, the height of the first picots **30** is equal to 1.3 millimeter whereas the height of the second picots **46** is equal to 0.7 mm. With a cylinder thus defined, associated with a cylinder with appropriate rubber coating, a ply of cellulose cotton of 22 g/m^2 is embossed and an average thickness H of the first ply **12** on the order of 0.8 mm is obtained.

The first picots **30** and the second picots **46** are tapered with a circular, oval, polygonal, or other shape section and preferably at a steep incline of between 60° and 70°.

The apexes **42**, **44** of the second projections **38**, **40** of the first ply **12** and second ply **14** are extended out facing and near the opposite and more or less axially aligned apexes **44**, **42** of the second projections **40**, **38** of the other ply **14**, **12**.

Such an embossed sheet **10** presents a suppleness greater than that of an embossed sheet made in accordance with known techniques while not having the mechanical characteristics and absorptivity diminished.

The suppleness of the sheet **10** is improved because, during the cambering of the sheet **10**, the apexes **42** and **44** of the second projections **38** and **40** can be slightly displaced one by the other, i.e., by being inclined and displaced as shown in FIG. **3**.

The mutual support of the apexes **42** and **44** of the second projections **38** and **40** inhibit the formation of a folding line harmful to the suppleness of the sheet and favors the cambering of the sheet **10**.

The mutual support of apexes **42** and **44** of the second projections **38** and **40** also permits the crushing of the sheet **10** to be minimized, which permits sheet **10** to conserve its bulk, i.e., its absorptivity.

In accordance with FIG. **2**, the apexes **42** and **44** of the second projections **38** and **40** can be in contact. They are not connected among themselves.

According to a variant shown here in FIG. **4**, the apexes **42** and **44** of the second projections **38** and **40** are separated axially by a slight gap indicated by the letter J.

FIGS. **2** and **4** show the second projections **38** and **40** which are symmetrical relative to the median plane of the sheet **10**, i.e., their heights H**1**, H**2** are all as equal as the heights H**1'**, H**2'**

However, according to a variant shown in FIG. **5**, the second projections **38** and **40** can be dissymmetrical.

Without departing from the scope of the invention, it is not necessary that the apexes of the facing second projections be perfectly aligned.

Nor is it required that there be an integral correspondence of the two projections of a ply with the second projections of the other ply.

As regards the performance of a sheet claimed for the invention, they are analogous to those of a corresponding product as known in the art with solely the first projections, with the exception of the suppleness of the sheet which is greatly improved.

In fact, tests have shown that the stiffness of the sheet according to the invention, i.e., the opposite of suppleness (measured according to the Geometric Mean Stiffness method), is reduced by more than 20% relative to the stiffness of the sheet made in accordance with known techniques.

The invention claimed is:

1. An embossed sheet comprising at least a first ply and a second ply of creped tissue paper having a basis weight ranging from 12 to 30 g/m^2, and said first ply and said second ply each comprising at least two embossed design patterns; wherein at least the first ply has a first embossed design pattern comprising a first series of first projections tapered and extending above an internal surface of the first ply, said first projections forming first alignments and having apexes in contact with an internal face of the second ply, and wherein the first ply and the second ply each have a second embossed design pattern comprising a second series of second projections extending above the internal surface of a corresponding ply, and having apexes of the second projections of one of said first ply or said second ply extend over and face and be near apexes of the second projections of the other ply;

wherein the apexes of the second projections of one ply are in contact with the apexes of the second projections facing the other ply; and wherein the second ply additionally has a first series of first projections and said first series of first projections of each of the first ply and the second ply are nested to each other.

2. The embossed sheet as claimed in claim **1**, wherein the apexes in contact with the second projections are not connected.

3. The embossed sheet as claimed in claim **1**, wherein heights of the second projections of the first ply and the second ply are substantially equal.

4. The embossed sheet as claimed in claim **1**, wherein the first series of first projections of the first ply and the second ply form the first alignments.

5. The embossed sheet as claimed in claim **1**, wherein the first projections form figures of a closed loop design.

6. The embossed sheet as claimed in claim **1**, wherein the second projections have dotted apexes.

7. The embossed sheet as claimed in claim **1**, wherein the second projections have linear apexes.

* * * * *